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**Southern Forest
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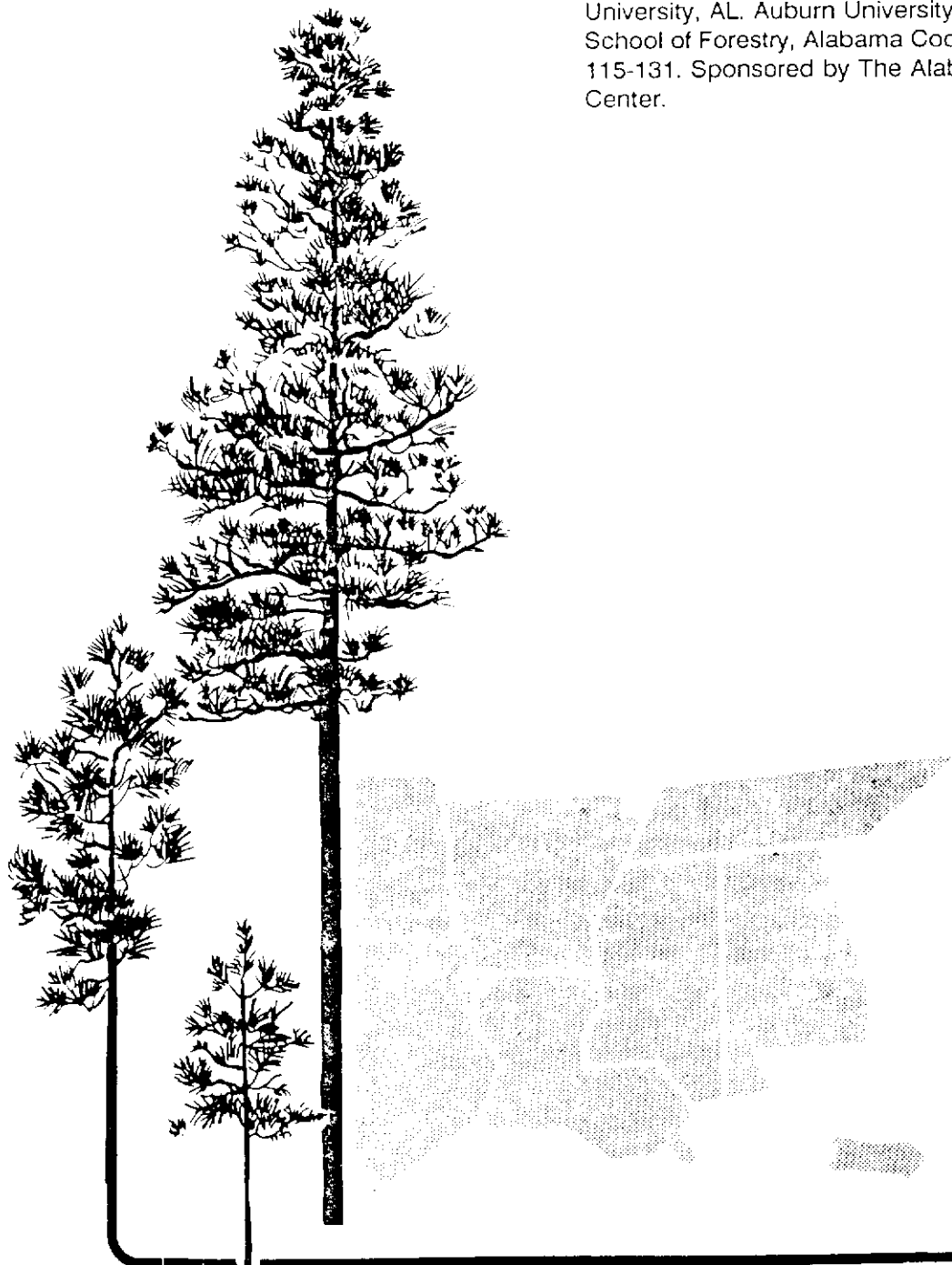
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AVAILABILITY OF YELLOW PINE SAWTIMBER IN ALABAMA

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Introduction

Alabama's timberland supports 76.2 billion board feet of sawtimber (International 1/4-inch Rule), of which 55 percent is contributed by yellow pine species. Currently, yellow pine sawtimber volume totals 41.8 billion board feet. The recent inventory conducted by the USDA-Forest Service, Southern Forest Experiment Station, Forest Inventory and Analysis Unit (SO-FIA) indicates that yellow pine sawtimber volume decreased by 1 percent over the past eight years (McWilliams in prep.). This trend reverses past findings of increases in yellow pine sawtimber. This paper discusses these findings and examines the availability of yellow pine sawtimber in the State.

Sawtimber Statistics

Two aspects of the SO-FIA inventory data bear mentioning. Before the 1990 inventory of Alabama's forests, SO-FIA modified its definition of sawtimber trees to include trees containing one 12-foot or two 8-foot logs anywhere in the sawlog section. Previously, only trees containing a 12-foot log in the lowest 16-foot section were classified as sawtimber trees. The modification was made to align SO-FIA's techniques with those used in other regions of the country and to facilitate the use of inventory findings across regional boundaries. Comparisons with previous inventory results are based on data that have been adjusted to conform as much as possible with current standards. Because the comparisons use adjusted data and not actual field measurements, exact comparisons are tenuous; however, it is possible to examine general trends.

Second, although the Doyle Rule is commonly used to express board foot volume in Alabama, SO-FIA uses the International 1/4-inch Rule to report inventory results because it is bound by national standards aimed at producing comparable estimates for all regions of the United States. For example, while

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the Doyle Rule is common in the South, the Scribner Rule is common in the Pacific Northwest. (For those who are interested, sawtimber estimates may be computed for any log rule by accessing the SO-FIA computer database interactively. There is a fee for this service.)

Yellow Pine Resource

Yellow pine species comprise nearly all (98 percent) of the softwood sawtimber volume in Alabama. As used here, yellow pine encompasses eight species. The species and their contributions to the total volume of yellow pine sawtimber are as follows:

<u>Common name</u>	<u>Scientific name</u>	<u>Percent of total yellow pine sawtimber volume</u>
Loblolly pine	<i>Pinus taeda</i>	60
Shortleaf pine	<i>P. echinata</i>	15
Longleaf pine	<i>P. palustris</i>	11
Slash pine	<i>P. elliottii</i>	7
Virginia pine	<i>P. virginiana</i>	4
Spruce pine	<i>P. glabra</i>	3
Pond pine	<i>P. serotina</i>	negligible
Sand pine	<i>P. clausa</i>	negligible

To simplify the analysis, Alabama is divided into two broad physiographic regions: Coastal Plain and Mountain (Hodgkins et al. 1976) (Figure 1). In relative terms, the Coastal Plain region contains a higher proportion of pine-type timberland and the Mountain region contains more oak-hickory timberland (Table 1). The Coastal Plain region accounts for 79 percent of Alabama's 41.8 million board feet of yellow pine sawtimber (Table 2), with highest concentrations in southwestern counties (Figure 2).

The volume of yellow pine sawtimber has decreased by 1 percent since 1982. In light of the modified definition of sawtimber trees used in the 1990 inventory, total volume can be considered to be roughly the same as it was in 1982. The volume of yellow pine in the Coastal Plain region increased by 1 percent (Table 3). Volume decreased by 10 percent in the Mountain region. These trends contrast with increases in volume that took place in both regions between 1972 and 1982 (Figure 3). Nearly all of the volume loss is occurring from natural pine stands. The volume in planted stands more than doubled in the Coastal Plain region.

Shifts in the distribution of yellow pine sawtimber by diameter class (the stock table) indicate that cutting trees in the 10- and 12-inch diameter classes is having an impact on overall inventory levels (Figure 4). Decreases were apparent in these classes in the Coastal Plain region but were offset by increases in larger diameter classes. More dramatic decreases in the 10- and 12-inch classes in the Mountain region were coupled with little change in the volume of larger diameter classes.

Between 1982 and 1990, the gross growth of yellow pine sawtimber in Alabama was 3.0 billion board feet (Table 4). Net growth—equal to gross growth minus mortality—was 2.7 billion board feet, and removals were 2.9 billion cubic feet. Removals of yellow pine sawtimber exceed growth in both the Coastal Plain and the Mountain regions. The growth-to-removals ratio is one measure of the resource's ability to expand in volume. The ratio is 1.0:1.0 for the Coastal Plain region and 0.9:1.0 for the Mountain region. Removals exceed growth in several counties across the State, so that a tightening of the physical supply of yellow pine sawtimber has occurred in many local areas (Figure 5).

Availability

The availability of yellow pine sawtimber depends on many interrelated factors that include physical conditions (quantity and quality), operability (harvest constraints), economics (supply, demand, and prices), and owner attitudes (harvester versus nonharvester) (McWilliams and Rosson 1988, May and LeDoux in press). Any one of these factors can constrain the volume that is available for conversion into timber products. The SO-FIA inventory results provide a considerable amount of information on the physical supply of sawtimber, some data on operability, and only limited information on owner attitudes. Some inference regarding owner behavior can be drawn by relating SO-FIA ownership information with separate ownership studies.

Volume per acre is perhaps the most significant physical factor limiting the availability of yellow pine sawtimber. Although the sale of pulpwood supplements removals of sawtimber, the existing board-foot volume per acre limits the feasibility of harvesting a given tract for sawlogs. Timberland supporting relatively low volume per acre accounts for a large share of the State's timberland (Figure 6). For example, roughly two-thirds of the pine and oak-pine timberland in Alabama supports 4,000 board feet per acre or less.

The quality or grade of the sawtimber inventory limits availability for some products. The current distribution of yellow pine sawtimber volume by log grade for grades one through three is 23 percent, 20 percent, and 57 percent, respectively. (SO-FIA assigns the entire sawlog volume to the grade of the lowest 16-foot section.) The distribution of volume by log grade is slightly better in the Coastal Plain region (Figure 7). While there may have been no major changes in the distribution of volume by grade, the volume of log grades one and two have increased between the two most recent inventories.

SO-FIA collects plot-level attributes that can be used to exemplify the interaction of physical constraints on timber availability. These attributes

include volume per acre, slope, tract size, and distance from a road. The data in Table 5 illustrate the impact of physical constraints. Each constraint was evaluated simultaneously with previous constraints to show the net affect of several constraints at once. After imposing all but the last constraint, yellow pine sawtimber inventory is reduced to 71 percent and 57 percent of the unconstrained SO-FIA estimate for the Coastal Plain and Mountain regions, respectively. The larger reduction for the Mountain region is due to the slope constraint. The choice of constraints, the number of constraints, and the selection of thresholds are all critical to the results. This example is just one of many possible formulations and is meant only as an illustration. If the example is extended to limit the sawtimber inventory to timberland owned by nonindustrial private owners (the last constraint), the available volume is reduced to 46 percent and 38 percent for the two regions.

Summary

The near-term outlook for yellow pine sawtimber is likely to be a continuation of trends that have developed over the past eight years. The conversion of older natural pine stands to young stands is the major cause for lack of significant change in yellow pine sawtimber inventory in the Coastal Plain region. Future increases in sawtimber inventory are possible if enough trees grow to sawtimber size. These increases will depend on future harvest levels, the relative size of trees being cut, adequacy of regeneration following harvest, and continued emphasis on management. Most of the overcutting of yellow pine is concentrated in upper Coastal Plain counties. Sawtimber inventory in southwestern counties continues to expand, because of management intensification. In the Mountain region, the overcut situation that has developed may not be overcome for some time. Some improvement in management has occurred but probably not enough to reverse current trends. With the exception of some areas of the lower Coastal Plain, the opportunities for expanding the harvest of yellow pine sawtimber are very limited if deterioration of the resource is to be avoided. The actual amount of yellow pine sawtimber available to forest products industries is probably less than the SO-FIA estimate would indicate because of a variety of limiting factors.

References

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- McWilliams, William H., and James F. Rosson, Jr. 1988. Hardwood availability in the midsouth uplands. In: Availability of Hardwoods in the Upland South. Series No. 7. Asheville, NC: Hardwood Research Cooperative. pp. 47-95.

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Table 1. – Area of timberland by broad physiographic region, forest type, and ownership, Alabama, 1990

Physiographic province and forest type	Total	Public	Forest industry	Nonindustrial private
-----Thousand acres-----				
Coastal Plain:				
Planted pine	2,934.4	29.8	1,321.5	1,583.0
Natural pine	2,915.7	146.1	710.6	2,059.0
Oak-pine	3,187.7	173.0	718.4	2,296.3
Oak-hickory	4,378.9	119.8	673.4	3,585.8
Bottomland hardwoods	<u>2,058.9</u>	<u>50.7</u>	<u>470.3</u>	<u>1,537.9</u>
All types	15,475.6	519.5	3,894.1	11,062.0
Mountain:				
Planted pine	503.2	16.7	223.2	263.2
Natural pine	1,109.2	144.9	154.6	809.7
Oak-pine	1,334.1	188.5	238.5	907.2
Oak-hickory	3,282.5	261.8	273.3	2,747.4
Bottomland hardwoods	<u>216.4</u>	<u>30.6</u>	<u>5.4</u>	<u>180.3</u>
All types	6,445.3	642.6	895.0	4,907.7

Rows and columns may not sum to totals because of rounding. Excludes 11.1 thousand acres of nontyped timberland.

Table 2. — Volume of yellow pine sawtimber by broad physiographic region, forest type, and ownership, Alabama, 1990

Physiographic province and forest type	Total	Public	Forest industry	Nonindustrial private
-----Million board feet -----				
Coastal Plain:				
Planted pine	4,944.9	28.0	2,057.3	2,859.7
Natural pine	15,094.9	1,002.2	3,994.9	10,097.8
Oak-pine	8,886.3	713.8	2,322.2	5,850.3
Oak-hickory	3,261.4	219.7	568.3	2,473.3
Bottomland hardwoods	<u>747.9</u>	<u>31.8</u>	<u>284.0</u>	<u>432.1</u>
All types	32,935.5	1,995.5	9,226.7	21,713.3
Mountain:				
Planted pine	668.2	...	195.9	472.3
Natural pine	4,276.1	946.6	396.0	2,933.4
Oak-pine	2,616.1	700.0	350.2	1,565.9
Oak-hickory	1,300.0	208.9	80.8	1,010.3
Bottomland hardwoods	<u>54.0</u>	<u>1.7</u>	<u>...</u>	<u>52.3</u>
All types	8,914.4	1,857.2	1,023.0	6,034.2

Rows and columns may not sum to totals because of rounding. Sawtimber volume is expressed as International 1/4-inch Rule.

Table 3. — Percent change in the volume of yellow pine sawtimber by broad physiographic region, forest type, and ownership, Alabama, 1982 to 1990

Physiographic province and forest type	Total	Public	Forest industry	Nonindustrial private
	----- Percent -----			
Coastal Plain:				
Planted pine	+ 103	(1)	+ 121	+ 90
Natural pine	-20	-39	-22	-16
Oak-pine	+ 14	-86	+ 8	+ 11
Oak-hickory	+ 27	+ 131	+ 10	+ 27
Bottomland hardwoods	-17	-62	-8	-15
All types	+ 1	-10	+ 2	-2
Mountain:				
Planted pine	+ 5	(1)	+ 60	-8
Natural pine	-25	+ 24	-45	-31
Oak-pine	+ 6	+ 53	+ 59	-12
Oak-hickory	+ 36	+ 1	+ 40	+ 44
Bottomland hardwoods	-11	(2)	...	-4
All types	-10	+ 30	-9	+ 17

(1) None sampled in 1982.

(2) Change is based on one plot only.

Table 4.— Average net annual growth, average annual removals, and average annual mortality by ownership, Alabama, 1982 to 1990

Component	Total	Public	Forest industry	Nonindustrial private
-----Million board feet -----				
Coastal Plain				
Net growth	2,182.6	59.9	628.8	1,493.8
Removals	2,217.6	87.4	704.0	1,426.2
Mortality	197.9	11.7	46.0	140.2
Mountain				
Net growth	562.7	56.3	96.0	410.4
Removals	638.7	18.2	103.4	517.1
Mortality	80.8	13.0	13.3	54.6

Rows and columns may not sum to totals because of rounding.
Sawtimber volume is expressed as International 1/4-inch Rule.

Table 5.--Physical availability of yellow pine sawtimber volume, Alabama, 1990.

Criteria	Volume of yellow pine sawtimber	Percent
	- Million board feet -	
Coastal Plain		
Initial value	32,935.5	100
Constraints:		
- Pine and oak-pine forest types	28,926.2	88
- Stands containing at least 3,000 board feet per acre	25,791.1	78
- Slopes less than 34 percent	25,569.1	78
- Forested tracts at least 50 acres	24,735.5	75
- Stands less than 0.5 miles from a road	23,290.1	71
- Nonindustrial private owners	15,020.5	46
Mountain		
Initial value	8,914.4	100
Constraints:		
- Pine and oak-pine forest types	7,560.4	85
- Stands containing at least 3,000 board feet per acre	6,368.8	71
- Slopes less than 34 percent	5,779.1	65
- Forested tracts at least 50 acres	5,259.7	59
- Stands less than 0.5 miles from a road	5,116.2	57
- Nonindustrial private owners	3,350.0	38

Sawtimber volume is expressed as International 1/4-inch Rule. Constraints are evaluated additively, in sequence from top to bottom.

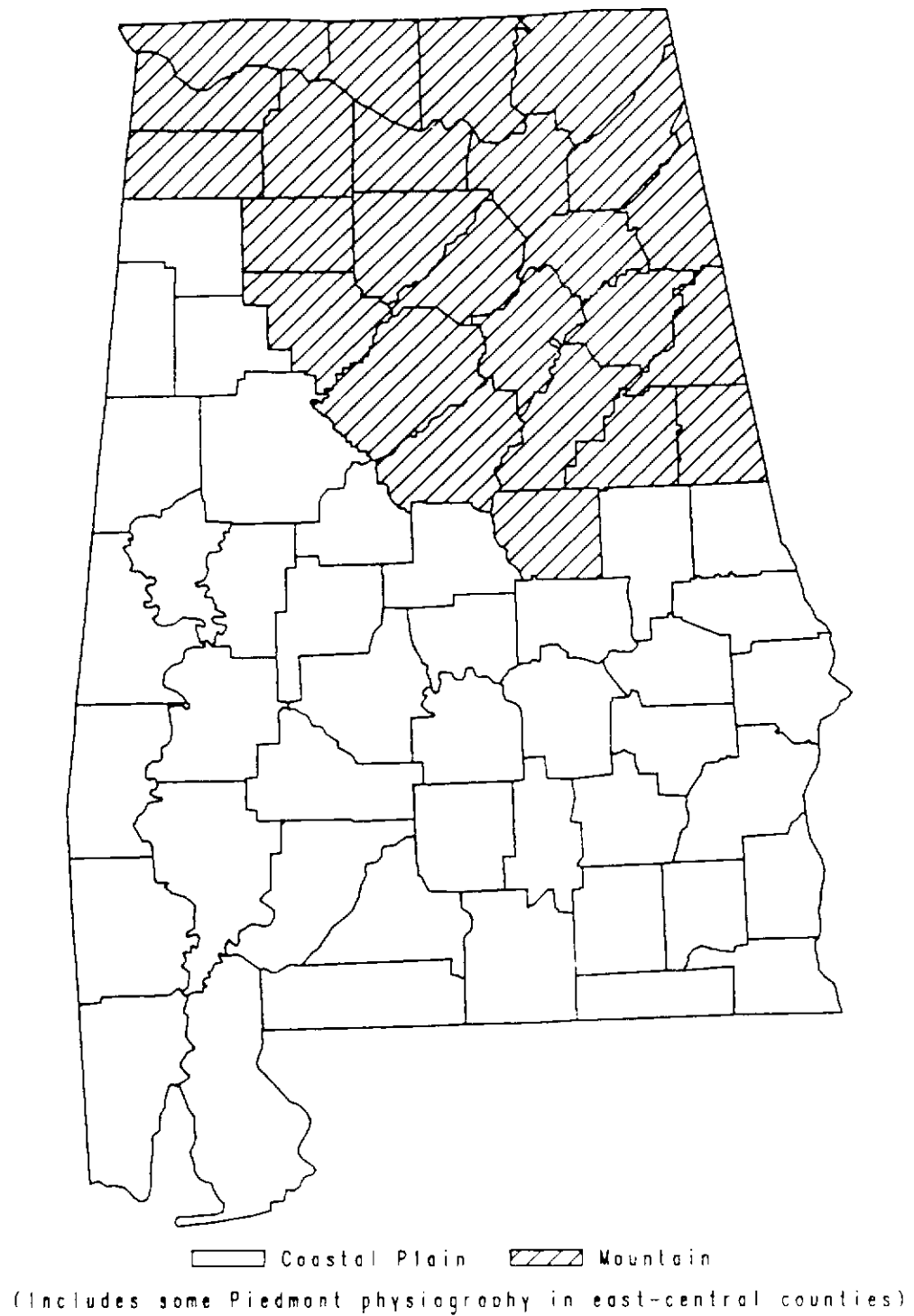
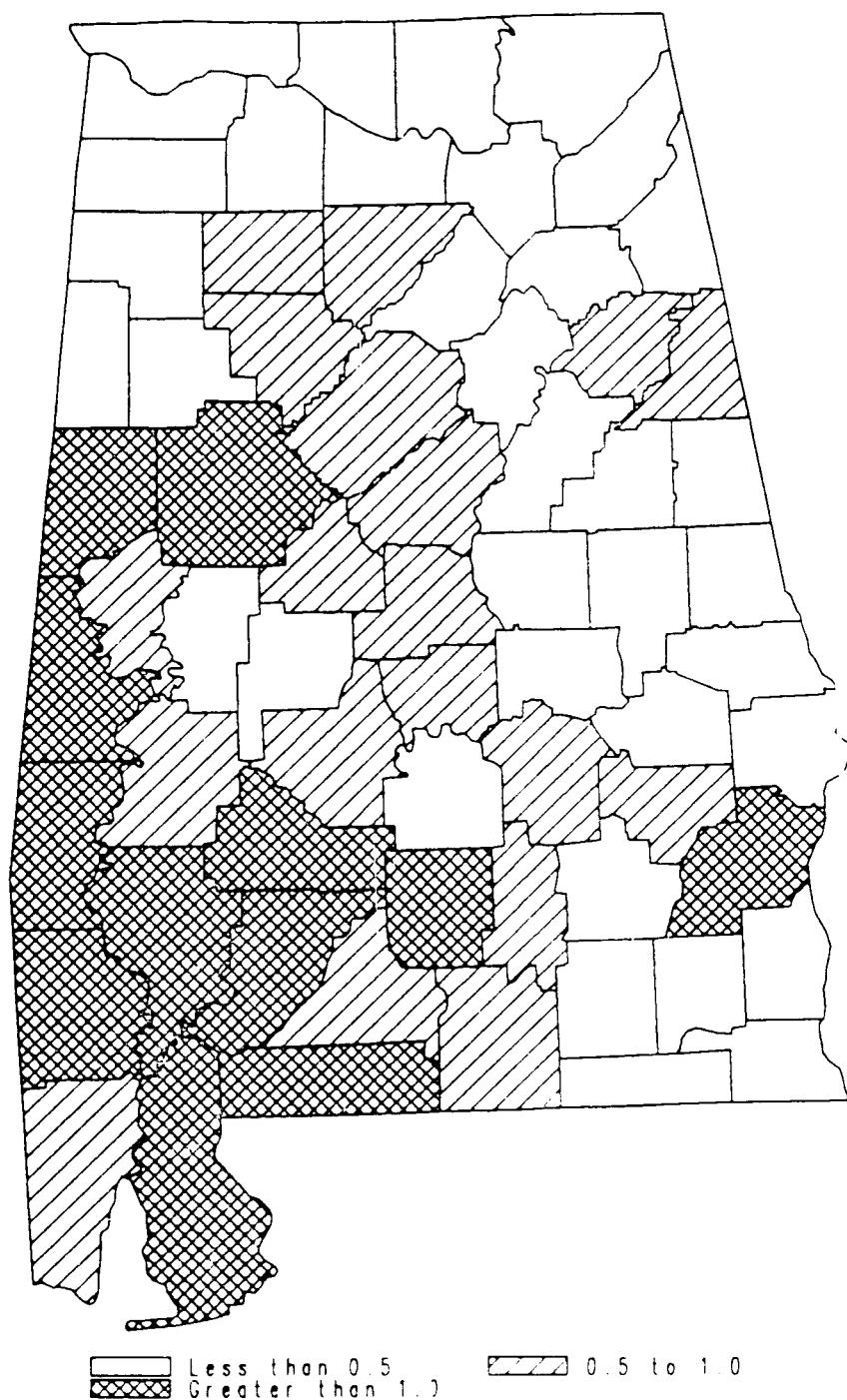


Figure 1. — *Broad physiographic regions of Alabama.*



(Expressed in billion board feet, International 1/4-inch Rule)

Figure 2. — *Volume of yellow pine sawtimber by county, Alabama, 1990.*

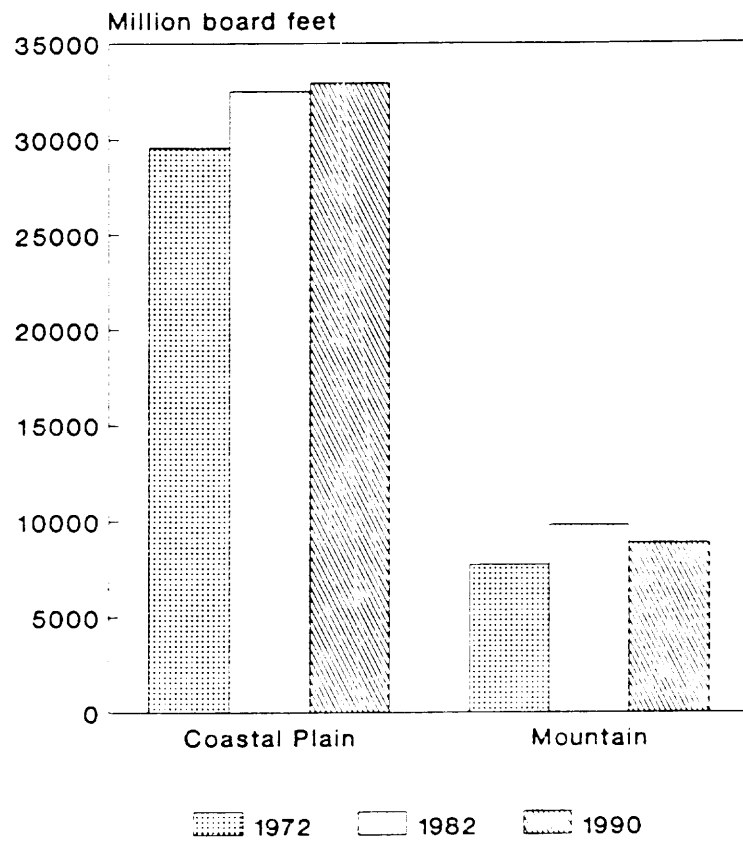
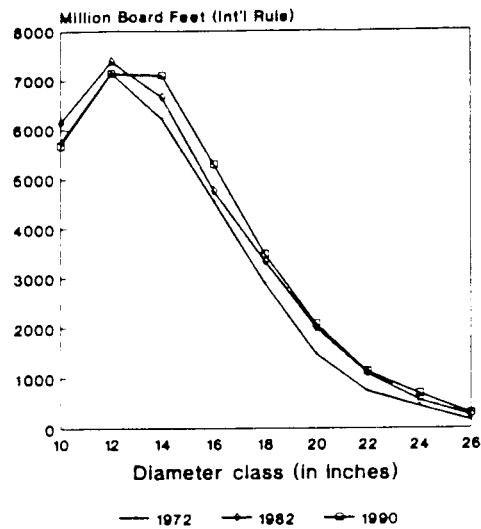


Figure 3. — *Volume of yellow pine sawtimber by broad physiographic region and inventory date, Alabama, 1972 to 1990.*

Coastal Plain



Mountain

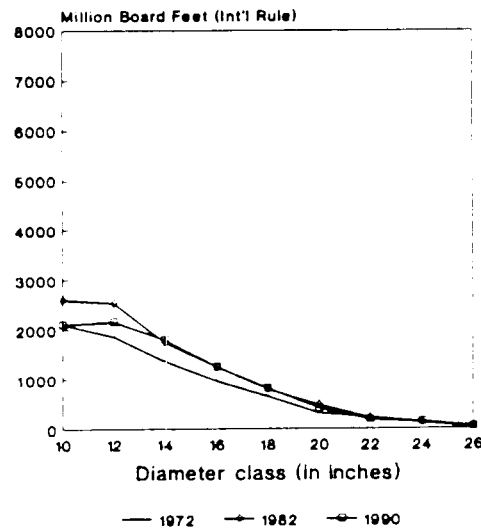


Figure 4. — *Volume of yellow pine sawtimber by broad physiographic region, inventory date, and diameter class, Alabama, 1972 to 1990.*

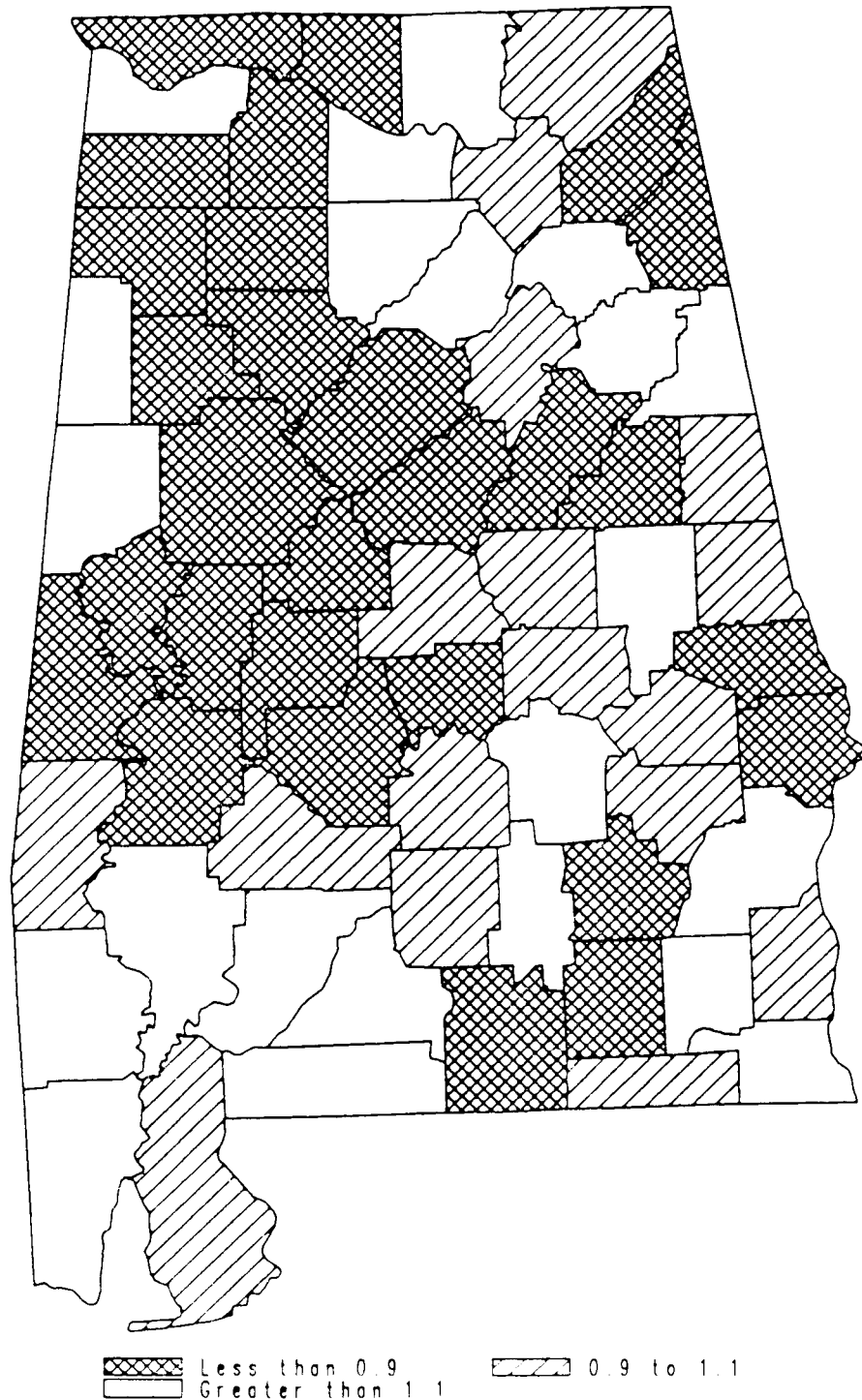


Figure 5. — *Ratio of average annual growth to average annual removals of yellow pine sawtimber by county, Alabama, 1982 to 1990.*

Board feet per acre
(International 1/4-inch Rule)

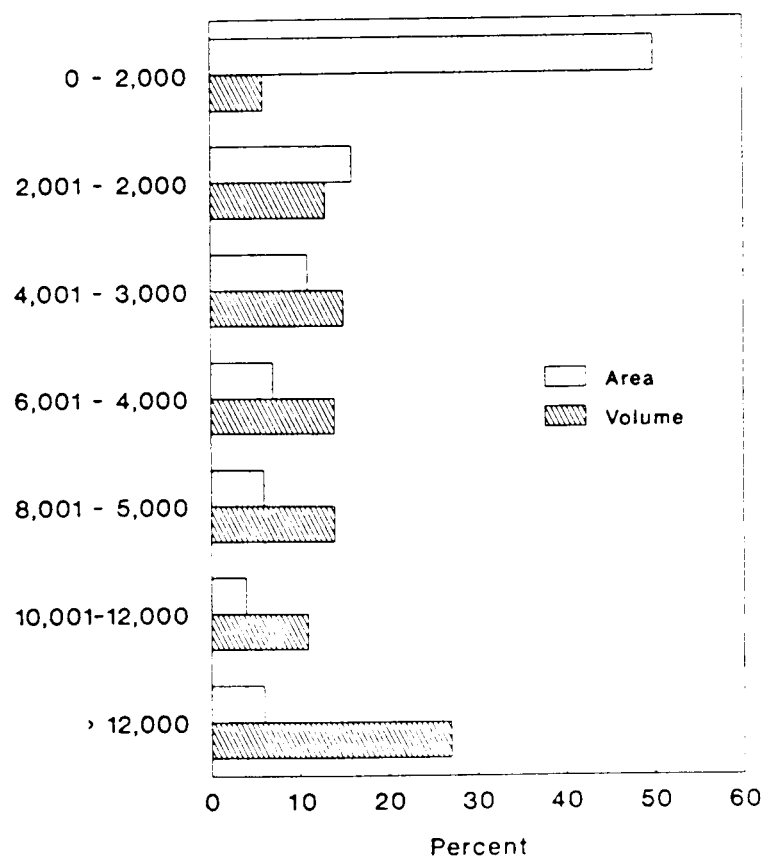
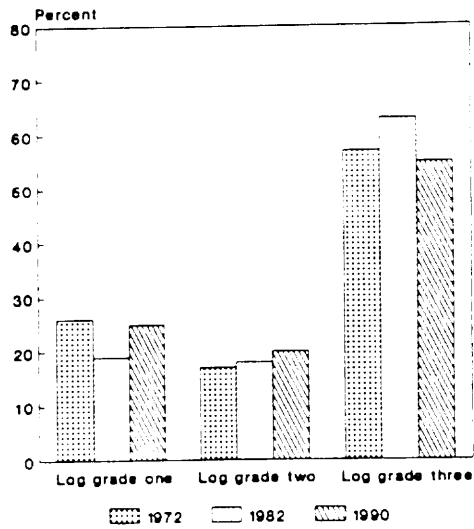


Figure 6. — *Area of pine and oak-pine timberland and volume of yellow pine sawtimber by stand volume class, Alabama, 1972 to 1990.*

Coastal Plain



Mountain

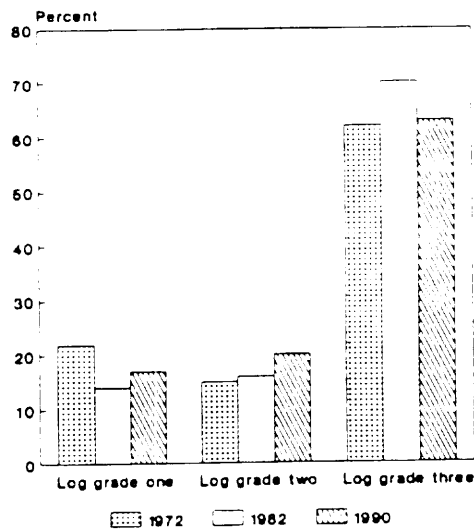


Figure 7. — Percent of yellow pine sawtimber volume by broad physiographic region, inventory date, and log grade for log grade three and better, Alabama, 1972 to 1990.